

# Response to West Coast Protected Species (Fish) Science Program Review Panelists' Comments and Suggestions

August 7, 2015

## Introduction

On May 4 - 6, 2015, the Northwest and Southwest Fisheries Science Centers (Centers) hosted a panel of experts to conduct a programmatic review of the science they conduct in support of conservation of fish listed under the Endangered Species Act (ESA). The review focused primarily on science conducted on ESA-listed Pacific salmon, but also included the Centers' research on other ESA-listed fish, including green sturgeon, eulachon, and three species of rockfish in Puget Sound. Additional details regarding the review can be found at: [http://www.nwfsc.noaa.gov/news/events/program\\_reviews/2015/index.cfm](http://www.nwfsc.noaa.gov/news/events/program_reviews/2015/index.cfm).

This review was the third in a series of annual reviews, conducted on a different theme each year over a five-year cycle, designed to maximize the transparency and effectiveness of major science programs located at the six Science Centers as well as those located in or coordinated through NOAA Fisheries' Office of Science and Technology. This review cycle focused on science conducted to support management of species under the Endangered Species Act and Marine Mammal Protection Act mandates. In order to provide a more focused review and to reflect our programmatic structure, the Centers divided the review into two parts, the review of ESA-listed fish discussed here and a second review focused on marine mammal and turtle science (<https://swfsc.noaa.gov/2015ProtectedMammalTurtleReview/>) held July 27-29 at the SWFSC in La Jolla, California.

Based on the Terms of Reference, the review focused on the following overarching questions:

1. Do current and planned protected species scientific activities fulfill mandates and requirements under the ESA and MMPA, and meet the needs of the regulatory partners?
2. Are there opportunities to be pursued in conducting protected species science, including shared and collaborative approaches with partners?
3. Are the protected species scientific objectives adequate, and is the best suite of techniques and approaches being used to meet those objectives?
4. Are the protected species studies being conducted properly (survey design, statistical rigor, standardization, integrity, peer review, transparency, confidentiality, etc.)?
5. How are advances in protected species science and methodological approaches being communicated and applied in NMFS?

To conduct the review, we selected experts in the topic area who were not associated with the Centers. The panel was provided with presentations from the Centers' staff providing both broad overviews of the Centers' programs as well as selected examples of specific projects. Panelists

were also provided with background material for more in-depth information, and had opportunities for direct discussion with staff during presentations and more informally during other portions of the review.

The results from this year's review, along with those being conducted at each of the other five fishery science centers and the Office of Science and Technology, will be used to prepare a national summary, to highlight best practices and to inform decisions on opportunities for improving science programs across NOAA Fisheries. The full suite of these reports will be found at: <http://www.st.nmfs.noaa.gov/science-program-review/>.

## **Acknowledgements**

We would like to thank the review panelists who devoted a significant amount of time to prepare for, and participate, in this review. Their observations and recommendations provide valuable feedback on a very complicated and diverse science program. The panelists for this review were:

- Daniel Schindler (Chair), University of Washington
- David Hankin, Humboldt State University
- Jennifer Ruesink, University of Washington
- Anke Mueller-Solger, U.S. Geological Survey
- John Kocik, NOAA Fisheries, Northeast Fisheries Science Center
- Ken Currens, Northwest Indian Fisheries Commission

Finally, we would like to express our appreciation to the Centers' staff for their contributions, insights, and candor during this three-day review. Preparing for such a review is a tremendous amount of work, particularly when coordinated across two science centers and four divisions, and our staff did a tremendous job.

## **Response**

Overall, the panel was clearly impressed with the science conducted at the Centers in support of managing protected fish species, and noted that our staff are talented and motivated, conducting cutting edge science with clear benefits to management. The panel provided a substantive report<sup>1</sup> with insightful findings, comments and suggestions. While we will bear in mind all of the comments as we go about our strategic planning and program management activities, we will undertake a series of actions in direct response to the panel's suggestions, outlined below.

Here, we provide our response to the major points identified in the summary report. We focus on points of where the panel noted areas that could be improved or where information was

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<sup>1</sup> PLACEHOLDER - report will be referenced when posted.

lacking, trusting that the many positive comments in the panel's report will speak for themselves.

## General considerations

**Cross center interactions:** *We encourage more scientific coordination between the NWFSC and SWFSC as they have much to learn from each other and better coordination will likely improve the impact of the science on management.*

We agree with this observation, and coordination between the two Centers has been increasing in recent years. For example, subsequent to the merger of the Northwest and Southwest Regional offices into a joint West Coast Regional Office (WCRO), there have been several multi-day retreats of the Regional Office and Science Center leadership to coordinate activities. We will continue these coordination efforts. In addition, we will expand upon existing collaborative working groups on high priority areas such as the life-cycle modeling and the Centers' ocean research programs (see below).

**Regulatory effectiveness:** *It was also unclear how NOAA evaluated regulatory effectiveness, particularly in the habitat restoration and protection work.*

We conduct monitoring and analyses that provide important information related to evaluating regulatory effectiveness at several different scales. These include economic analysis of broad scale harvest management strategies (e.g., catch shares), analysis of forecast and observed harvest rates, input into the design and analysis of dam passage survival monitoring programs, analysis of broadscale trends in habitat status, and routine assessment of the progress of protected species towards recovery (e.g., the 5-year ESA status reviews we are undertaking with the WCRO in 2015). As much as possible, we have established monitoring programs to evaluate the effectiveness of habitat restorations actions. We also provide direct forensic support to law enforcement for investigation and prosecution of take violations. Other than economic analyses of harvest regulations, we do not currently conduct theoretical investigations into regulatory effectiveness, although this might be something to consider in the future (see also comment below on integration with human dimensions science).

**Integration with human dimensions:** *The complete lack of discussion of coordination between the natural sciences and economics and other social sciences was noteworthy. Given the immense complexity involved in recovery planning for protected species, the panel stresses that more effort should be placed on integrating the relevant social and natural sciences that bear on recovery efforts.*

The timing for this recommendation is propitious, as the NWFSC has recently hired a natural resource economist who will be working, at least in part, on salmon recovery issues and the SWFSC is exploring expanding their existing economics group into this area as well. In addition, we have a good record of integrating economic and social sciences into integrated ecosystem assessments and other ecosystem analyses such as ecosystem services valuations. For our 2016 Annual Guidance Memoranda, we will explicitly develop strategies for greater integration of our human dimensions and salmon recovery science programs. The SWFSC has

a number of economists, but they mainly work on sustainable fisheries issues. In future hires, we will explore opportunities to expand into protected species issues and other social science disciplines. It should also be noted that Social Science programs will undergo their reviews in 2017 offering an added opportunity to further define key needs.

**Funding and staffing:** *The panel also highlights that the lack of funding for making new permanent hires is a serious risk to the long-term institutional memory of protected species science in the agency. How will NOAA maintain their institutional memory of protected species science on the west coast? This is going to require tough politicking and making difficult decisions about which scientific programs to continue investing in. Some strategic planning focused on strategies for replacing senior scientists over the next decade should be done very soon.*

We agree with this observation, and are acutely aware of the lack of funding for maintaining staffing levels. As a line office, NMFS has in recent years instituted more rigorous hiring procedures including development of annual staffing plans. In addition, the Science Centers are in the process of developing our own strategic hiring plans, focusing on maintaining expertise and sufficient capacity in critical areas where we can make the most important contributions to protected species science, particularly in cases where important expertise may be lost due to retirement.

Panelists identified a number of challenges in this area, including increasing reliance on contractors, term hires, and postdocs at cooperative institutes (CIs); an aging federal workforce; and a lack of diversity in mid-level and senior ranks. These challenges arise from a common source: increasing demands for science, declining internal budgets, and rising reliance on reimbursable funds from other agencies. This is an area where there are also national level deliberations on strategies for maintaining critical mass in key areas.

## **Theme 1 - Overview and strategic planning:**

*It would have been helpful to the review panel (and helpful to NOAA Fisheries in the long-term) to develop a process that will be used to prioritize science activities moving forward; a structured decision-making framework would help immensely.*

All NMFS Science Centers have developed long-term strategic plans to prioritize scientific activities<sup>2</sup>. These plans are also used to develop an Annual Guidance Memoranda and Implementation Plans that set the context for annual work plans driven by available resources. The Centers' salmon science programs are large, diverse and multidisciplinary, making prioritization important but also complex, involving trade-offs between disparate activities and constant interactions with the WCRO. We hold weekly leadership calls for the Centers and WCRO, and hold two meetings annually of senior management of the Centers and WCRO to discuss and set priorities. In addition, there are strong ongoing interactions between science and management staff around the four H's -- Hydro, Habitat, Harvest and Hatcheries to identify priority science needs for management.

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<sup>2</sup><http://www.nwfsc.noaa.gov/about/planning/index.cfm> and <https://swfsc.noaa.gov/textblock.aspx?id=19643&ParentMenuId=6>

## **Theme 2 - Monitoring and sources of data:**

*NOAA has generally done a very good job with a difficult problem in its attempts to coordinate with a variety of partners collecting data on protected species and their habitats on the west coast. However, it was not clear how data quality is assessed, particularly those collected by partners. This needs to be made a higher priority.*

Compiling and using information from a wide variety of sources has been a feature of the Centers' salmon science program for many years. We have either instituted or participated in a variety of multi-agency forums for the purpose of evaluating, improving and documenting data quality. NOAA Fisheries has also provided funding to state and tribal fishery agencies to support improvements in data quality and data management.

Reviewers noted that population monitoring was much more extensive and intensive than habitat monitoring, although delisting determinations depend on documenting that the habitat degradation that led to listing has been rectified. Habitat monitoring is typically labor intensive and is typically done for a subset of populations at relatively small scales. Several areas have been identified as Intensively Monitored Watersheds (IMWs), and the challenge remains on how to systematically apply those data to populations that do not have habitat data. The Centers will form a working group to review the state of the art for on-the-ground and remote sensing-based methods to monitor habitat, evaluate existing habitat monitoring and remote sensing programs that could provide salmon-relevant data, identify gaps in existing monitoring, establish coastwide standards, and develop a plan to fill the gaps.

## **Theme 3 - Habitat science**

*We encourage the monitoring programs to become better integrated with the life-cycle modeling efforts. Modeling can be used to assess the monitoring, and vice versa, more so than it currently is. The habitat science would benefit from more explicit integration with both life-cycle modeling and with economics. The former would be useful for better understanding biological responses to restoration. The latter would be useful for developing more formal assessments of the costs, benefits, and risks of individual habitat projects.*

We agree with this observation and we are actively working to integrate habitat monitoring with life-cycle modeling. A good example of this is the Columbia Habitat Monitoring Program (CHaMP), whose data is explicitly integrated into a life-cycle modeling framework and whose staff participate in a broader NMFS-led life-cycle modeling working group. Such integration can continue to be improved, however, particularly in Puget Sound where NMFS is leading a newly developed habitat-monitoring program for mainstems, floodplains and nearshore areas. See response above related to better integration of economics into salmon recovery science.

*The Elwha River restoration is a remarkable opportunity to learn about river restoration. The panel was impressed with the quality of the results that were summarized from the first years of the restoration. In general, the panel felt that the Elwha research program was not given the status and funding that it probably deserves given the unique opportunity it presents.*

We agree that the Elwha River restoration is a fantastic opportunity, both scientifically and for salmon recovery. We will continue to conduct research in the Elwha River, particularly as populations recolonize the system. At this time of at best a flat NMFS budget, most of this research will likely continue to be funded with outside sources. Nonetheless, in 2016 the NW Center is making it a priority in our annual guidance memorandum to assess if we can direct more effort to the Elwha.

*The contaminant science was interesting and clearly at the cutting edge of this discipline. However, the panel believes there could be more attention focused on integrating this work with the other recovery sciences. Again, life-cycle modeling provides the framework for this, assuming it is developed appropriately.*

We are presently conducting geospatial analyses to assess the cumulative impacts of coastal development on salmon populations, drawing upon statistical and life cycle modeling expertise from other groups within the NW Center. As part of this effort, we will begin to incorporate lethal and sub-lethal effects of contaminants into existing life-cycle models. Also, we are working closely with the Office of Protected Resources and, by extension, the EPA to expand the use of life-cycle modeling in national-scale risk assessments for chemical contaminants and endangered species. By the end of summer 2015 we will add postdoctoral research expertise to develop new life cycle models for salmonids migrating through historically contaminated areas (e.g., Portland Harbor, the Duwamish Waterway in Seattle), in coordination with the EPA and NOAA National Ocean Service.

*We encourage the NOAA contaminant program to develop a national strategy describing its research goals in this area. It is also critically important to coordinate this effort with other federal agencies (i.e., EPA) to maximize its success.*

Efforts are underway with the NMFS Science Board and NOAA leadership to develop a national strategy for contaminant research within NOAA Fisheries. The goal of this initiative is to identify challenges, redesign the agency's research platform, develop key interagency and academic partnerships, and modernize technical capacity to keep pace with rapid advances in environmental health science. Three initial major challenges include: 1) Future pollution threats to Arctic ecosystems, 2) Land-based pollution threats to protected corals and coral reef habitats, and 3) Clean water science to promote sustainable fisheries in coastal habitats. We are working closely with the EPA and the USFWS to identify non-point source pollution threats to coastal watersheds and nearshore habitats, and to validate pollution control strategies to protect NOAA trust resources. Coordination with the EPA includes a six-month detail of a NWFSC researcher to EPA to advise on designing rules and regulations on pesticides.

#### **Theme 4 - Climate change**

*A key strength of the science focused on climate change is in developing decision support tools to explore the implications of changing climate on protected species and their habitat. In general the panel felt this research area would benefit greatly from more investment by NOAA. Better integration with life-cycle modeling will improve the value of the climate*

*science. We encourage NOAA science and policy teams to explore whether recovery criteria can be revised based on climate projections.*

We agree with these observations, and in the more recent recovery plans have started to more explicitly conduct and consider climate analyses. We will also include climate researchers on the life-cycle modeling working group discussed below. Also, the recent hire of Nate Mantua from UW's Climate Impacts Group to head up the SWFSC's life cycle modeling group was made with this in mind. We will work with the WCRO recovery coordinators to determine if, how and when recovery objectives should be revised to include climate projections.

## **Theme 5 - Survival in rivers**

*Much of the work studying survival in rivers is well-founded, question-driven science. In the California Central Valley, the research is particularly strong. In the Columbia River the research seems somewhat ad hoc (though we realize it is a much larger and more complex ecosystem). Work in the Columbia River would benefit from more coordination among the various groups within and outside NOAA who are executing the science to quantify survival in the river. Again, more explicit effort within the life-cycle modeling would likely help achieve this.*

As the reviewers noted, we provided information on NOAA survival studies but did not provide a comprehensive overview of all survival studies in the Columbia River basin conducted by NOAA and partners. However, much of this activity is coordinated by several entities. For instance, under the Federal Columbia River Power System (FCRPS) Biological Opinion, survival estimation is implemented to determine whether survival performance standards are met by migrating juvenile salmonids. In addition, the Northwest Power and Conservation Council has a process to review proposed studies to ensure that they are consistent with their Fish and Wildlife Plan. NOAA's COMPASS model of hydrosystem survival incorporates data from over 15 years of survival studies in the Snake and Columbia Rivers. Nonetheless, as we prepare analyses for the latest FCRPS Biological Opinion for 2018, we will systematically assess the availability of PIT-tag survival data, both within the hydrosystem and in the tributaries, to populate our life-cycle and hydrosystem models.

## **Theme 6 - Estuary and Ocean**

*Reviewers found the current sea-going research on Pacific salmon to be relatively lacking in clear hypotheses, experimental design and connections to management needs. Also, NMFS, as the sole agency with a clear marine mission, seems to pay relatively little attention to ocean issues compared to freshwater and estuarine ones, which do receive attention from other agencies.*

We acknowledge this point, and have recently completed an internal "Synthesis of Ocean Research" report to address some of these issues. In particular, we addressed how to make ocean research more responsive to key management issues such as density-dependent effects between wild and hatchery fish in the ocean, and the impact of arrival timing of juveniles to the

estuary on their subsequent return rate. To continue along this path, the Centers will form a working group to consider how available ship time and related resources could best be spent to maximize the impact of NMFS ocean salmon science. Working group members will include salmon ocean ecology staff, stock assessment scientists, life cycle modelers, and other relevant staff to answer these questions:

- What can be learned from ship-based observations of salmon and their ocean environment, including their prey and predators?
- Could salmon-related work be carried out on other surveys such as the coastal pelagic species and sardine-hake surveys?
- How can ocean information be used to improve harvest management, for example, with pre-season forecast models?

The working group will produce a report outlining the future direction of ocean salmon ecological investigations and an organizational plan for funding and conducting this work.

## **Theme 7 - Harvest**

*It is unclear whether NOAA routinely assesses whether exploitation rates on protected stocks are appropriate for enabling recovery. Such assessments should use state-of-the-art statistical approaches for estimating and understanding uncertainties (observation and process errors) in estimates of stock-specific harvest rates.*

Both Centers have provided analyses evaluating the relationship between proposed exploitation rates and probability of recovery. A state-of-the-art example was provided for the Sacramento Chinook salmon, and similar analyses have been conducted for Puget Sound and Lower Columbia River Chinook salmon. We will continue to provide these types of analysis as necessary to support salmon management, and will evaluate whether there are statistical improvements that can be made to better understand and quantify uncertainties.

*The panel noted that both parentage-based tagging and genetic analysis of ocean-caught salmon for stock identification purposes had potential and were intriguing, but suggested that more could be done to explore their utility.*

We agree that the utilization of genetic methods in management of harvest and hatcheries is still emerging. While not presented in detail to the panel, Center scientists are actively engaged with the Pacific Salmon Commission and related efforts to establish the potential benefits, costs and requirements of genetic-based tagging and stock identification in salmon fishery and hatchery management. In addition, Center scientists have been directly involved in the implementation of genetic methods in hatchery and harvest management as part of their involvement in the formulation of management plans and best management practices for hatchery programs throughout the region, and through engagement with the Pacific Fisheries Management Council's advisory bodies.



## **Theme 8 - Hatcheries**

*The panel was impressed with the high level of integration across the hatchery science work. One potential weakness was the focus on the genetic and life-history dimensions of hatchery effects with very little focus on understanding potential ecological effects on wild fish. Some concern was raised about how NOAA was involved in planning, implementing, and assessing re-introductions.*

We agree that greater understanding of the ecological interactions between hatchery and natural salmon is a high priority, although not an easy one to address in a quantitative way. Establishment of long-term, detailed ecological evaluations of populations with easily identifiable hatchery and natural origin fish will be undertaken in coming years. For example, we will work with the WCR to develop an explicit monitoring plan for evaluating the overall effects of hatchery supplementation on Snake River Fall Chinook, which will be included in the recovery plan. Regarding reintroductions, we recently published a paper summarizing guidelines for salmon reintroductions, and are actively working with the regional office and other partners to provide technical support on reintroductions in numerous locations, including basins of the Willamette River, Lower Columbia River, Puget Sound, California Coast and Central Valley regions.

## **Theme 9 - Evolution and life-history**

*The research on evolution and life history variation in protected salmon is world-class. However, some self-assessment of management relevance of the research in this theme would certainly be worthwhile.*

We agree that working to better understand how diversity relates to management goals is an important priority. This is another area where better integration with life-cycle modeling efforts, which can help quantify relationships between diversity and abundance and viability, will be helpful. In addition, there are obvious connections to climate change that we believe could be better developed. We also agree that the management relevance of some of the Center's work on the evolution of life-history variation is not readily apparent, but note that such basic research is critical for understanding how salmonid populations respond to management actions and to predict how they will respond to environmental change.

## **Theme 10 - Life-cycle modeling and synthesis**

Reviewers identified several challenges to effective use of life cycle models in salmon management that could be addressed by joint attention and improved organization. We will form a working group and prepare a paper reviewing the kinds of life cycle models under development at NMFS, their strengths and weaknesses for different applications, strategies for estimating model parameters and accounting for uncertainty, data management to support modeling, and prospects for future development. We will submit this paper to a peer-reviewed journal by the end of 2016.

In addition, we will continue to develop and expand our life-cycle modeling methodologies. In particular, we will develop methods to make our models more statistically rigorous by calibrating the models using all data sources simultaneously while maintaining proper variance and covariance structures. We will explore ways to extrapolate information from populations with rich data to those with poor data, and we will expand our use of spatial structuring of populations to better understand how populations interact. Finally, as stated above, we will better incorporate into the models many important factors such as climate change, hatchery-wild interactions, effects of contaminants, and effects of habitat restoration.

### **Theme 11 - Non-salmon species**

The panelists provided useful guidance on where to focus future green sturgeon research and monitoring. We will incorporate these recommendations into the green sturgeon recovery plan, and work with partners (e.g., USFWS, UC Davis) to develop methods for assessing recruitment.

### **Summary of action items:**

<b>Theme</b>	<b>Action item</b>	<b>Schedule</b>
General	1. Develop strategies for greater integration of human dimensions and salmon recovery science.	2016 Annual Guidance Memoranda
1	2. Develop strategic staffing plans to address retiring senior scientists	Nov, 2016
2, 3	3. The Centers will form an internal working group to review the state of the art for on-the-ground and remote sensing-based methods to monitor habitat, evaluate existing habitat monitoring and remote sensing programs that provide salmon-relevant data, identify gaps in existing monitoring, and recommend coastwide standards.	The working group will be formed by December 1, 2015, and will produce a report by Sept 1, 2016.
3	4. Hire a postdoctoral scientist to develop new life cycle models for salmonids migrating through historically contaminated areas. Research will be in coordination with the EPA and NOAA's National Ocean Service.	Sept, 2015
3	5. Actively work with the Office of Science and Technology to develop 2018 budget initiative for contaminant research.	Ongoing
3	6. Coordinate with the EPA on a six-month detail of a NWFSC researcher to EPA to advise on designing rules and regulations on pesticides	July, 2015 (completed)

4	7. We will work with the West Coast Region recovery coordinators to determine if, how and when recovery objectives should be revised to include climate projections.	Feb, 2016
5	8. As we work with the WCRO to support the latest FCRPS Biological Opinion for 2018, we will systematically assess the availability of PIT-tag survival data, both within the hydrosystem and in the tributaries, to populate our life-cycle and hydrosystem models	June, 2018
6	9. The Centers will form a working group to define how available ship time and related resources could best be spent to maximize the impact of NMFS ocean salmon science. The working group will produce a report outlining the future direction of ocean salmon ecological investigations and an organizational plan for funding and conducting this work.	Group will meet in Jan 2016 and provide a report by June 2016.
7	10. We will continue to provide analysis of the effects of harvest actions on recovery as necessary to support salmon management, and will evaluate whether there are statistical improvements that can be made to better understand and quantify uncertainties.	As needed to support WCRO biological opinions on harvest management plans.
8	11. We will work with the WCRO to develop a monitoring plan for evaluating the overall effects of hatchery supplementation on Snake River Fall Chinook salmon. We will continue to work with the WCRO, states and tribes to monitor ecology effects or develop plans to do so (e.g., Nisqually, Grand Ronde, and Wenatchee Chinook).	Snake River plan - Feb, 2016 Work in other areas - ongoing
9, 10	12. We will form a working group and prepare a paper reviewing the kinds of life cycle models under development at NMFS, their strengths and weaknesses for different applications, strategies for estimating model parameters and accounting for uncertainty, data management to support modeling, and prospects for future development.	Paper submitted for publication by Dec 31, 2016.
10	13. We will continue to develop and expand our life-cycle modeling methodologies to make them statistically more rigorous and to better incorporate evolutionary processes.	Report prepared for review by Independent Science Advisory Board by March 2017.